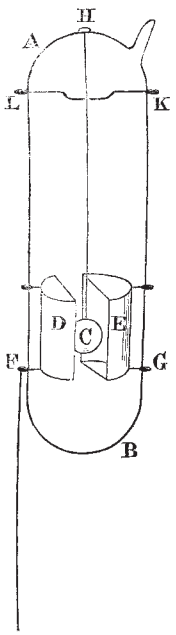
## Influence of a Vacuum on Electricity

THE theory of Prof. Edlund that a perfect vacuum is a perfect conductor of electricity, but that a discharge across such a vacuum between two electrodes is prevented by an electromotive force at the surface of the electrode, involves our attributing to the vacuum the property of screening from electrical influence any body which it envelops. If the vacuum be a conductor, what we call induction cannot take place through it.

Not having been able to find any record of an experiment which conclusively proved that a vacuum so perfect as to offer considerable resistance to the passage of a current nevertheless permitted induction to take place through it, I have tested the matter by means of the apparatus shown in the figure.




AB is a glass tube about 15 cm. long; C is a light hollow platinum ball, 1 cm. in diameter, hung by a fine platinum wire from the top of the tube between D and E the two separated halves of a cylindrical platinum box, which are insulated from each other and held in position by platinum connections sealed into the sides of the tube, and projecting to the outside at F and G.

It is of importance to mention that the upper terminal H, from which the sphere hung, does not reach more than about 3 millimetres above the inner surface of the tube. The two halves of the cylindrical box are sufficiently near together to prevent the ball coming in contact with the sides of the glass.

This tube was exhausted until an induction current, would give a 12-millimetre spark in air, rather than pass between two terminals, K L, sealed in the upper part of the tube with their opposed ends about half a centimetre apart.

A wire about 30 cm. long was then hung from F, and an electrified body presented to the lower end. On the approach of this body to the wire the sphere was at once attracted towards D, and when a discharge was permitted between the electrified object and the wire, the sphere was violently attracted, and a minute spark was seen when the wire holding it touched the cap of the box D. The sphere was then repelled by the similarly charged box.

It thus appears that the phenomena of electric induction take place across a discharge-resisting vacuum, and that the sphere hung in it is not screened from electrical influence as it would be if surrounded by a conductor. A. M. WORTHINGTON

Clifton College, Bristol, February 22

## The Meteoroid of November 17, 1882

THERE has already been much discussion on this subject, but I do not think that such exceptional phenomena lose any of their interest by having happened a few months ago; and so I write partly to correct a misapprehension on the part of Mr. Backhouse and Mr. Groneman as to the bearings of the positions of appearance and disappearance of the meteoroid as seen by myself. It seemed to me to appear in the S.E.E. and disappear S.W. by S., but these are not the directions of those points where the trajectory and the horizon would intersect. By mentally continuing the apparent path down to the east and west horizons, points would be reached, nearly, but I think not quite, 180° apart, the former about 20° N. of E. and the latter nearly opposite, so that I scarcely think that it was a great circle, but it is very uncertain. Mr. Saxby states that a similar cloud was observed to cross the zenith of Brussels by M. Montigny. Now there are two accounts—one by M. Zeeman of Zierickssee and the other from near Rye (Sussex)—which seem to consistently apply to one and the same thing, for the latter place is W. by 20° S. from Zierickssee, and from both places the same elevation of about 50° was reached. These accounts, if combined with that from Brussels, indicate a height of about 70 miles; but then how does such a height agree with some of the English observations? On the supposition of the above height, the altitudes of culmination as seen from Woodbridge and Windsor would be about 29°, from Bristol 25°, and from York 10° only, which last angle is directly at variance with the actual one. For my part, I will give up the reconciling of such contradictory evidence to those who have an aptitude for conundrums. The evidence is in favour of this being an auroral manifestation, but the spectrum of the cloud does not prove this, for as yet it is not known whether the extremely rarefied upper atmosphere may not be excited to such incandescence as will yield the so-called "auroral" spectrum by other means than the electric discharge, as, for instance, by the passage of a cloud of meteorites. Mr. Petrie upholds the latter hypothesis, but I think that there is a simple but weighty objection to it; for it is difficult to see how a cloud of meteoric dust of such closeness and defined form as the appearance of this cloud would imply, could travel through space for any length of time without coalescing into one granular lump, owing to the mutual gravitation of its particles. Of course this objection will have the less weight the smaller we suppose the individual particles to be. This argument will scarcely apply to the well-known meteor streams, whose individual particles are really so very far apart. If this "flying arch" was subject to gravity, it certainly had more than sufficient velocity to prevent it being appropriated by our earth as a satellite, for the tangential speed necessary to a circular orbit of 4100 miles radius round our earth would only be about $4\frac{3}{4}$ miles per second, with a period of $1\frac{1}{2}$ hours. All interested in this phenomenon will no doubt pay more attention to the southern sky during future auroras, in hopes of noting something more of a similar nature, and they will also look forward to seeing a full account of Prof. Lemström's remarkable experiments on the nature of the aurora, which he has been conducting at Sodankylä with such unlooked-for results.

Heworth Green, York H. DENNIS TAYLOR

## A Meteor

LAST evening at 9.35 p.m. a remarkably large and brilliant meteor was seen from here, appearing at a point about 10° east of $\eta$ Canis Majoris, passing slowly over that star in a south-west direction, and vanishing a few degrees above the horizon; time about three seconds. Its light had a pale green tint, and in brightness and apparent diameter it far exceeded Sirius (which was particularly bright all the evening), so much so that my companions, though not looking in that direction, were instantly attracted by the light, and saw it in its splendour.

R. W. S. GRIFFITH

Eyeworth Lodge, Lyndhurst, Hants, March 3

## Aurora

LAST night at about ten o'clock there were two beautiful white auroral streamers, like the tails of enormous comets, near the Pleiades. They were nearly vertical, and slowly moved, in a direction parallel to the horizon, towards Orion, after which they gradually vanished. There was little wind, and the night was bright starlight, after a cloudy day. There was an auroral glow like twilight over the northern horizon. The barometer rose during yesterday and last night, and stands high.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, February 28

## Hovering of Birds

WITH regard to Mr. W. Clement Ley's remarks, I have already been permitted to explain in NATURE (vol. xxvii. p. 366) how I had accidentally misunderstood Mr. Airy's meaning. I do not believe that any bird having a greater specific gravity than the air can retain a perfectly fixed position in a calm without some wing-motion. Mr. Ley "believes that there is nothing in the etymology of the word 'hover' that implies movement." This has induced me to look up a somewhat voluminous and recent dictionary, in which I find "Hover, *v.i.* (W. hoviaw, to hang over, to fluctuate, to hover). To flap the wings, fluttering or flapping the wings with short irregular flights"; and more to the same effect, all indicating movement. J. RAE

## *AMATEURS AND ASTRONOMICAL OBSERVATION*

THE labour done by astronomical amateurs has had no little influence upon the progress of the science. The work achieved by them has indeed often been of the

utmost value, and a long list of names might be adduced of those who in past years attained a most honourable position either as discoverers, as systematic observers, or as both. Seeing therefore that amateurs, whose efforts are purely disinterested and the natural outcome of a love for the subject, have contributed so largely to place our knowledge of astronomy in its present high place, their efforts should be encouraged and utilised by their contemporaries, who hold official positions, and who may find it convenient to assist them by some of that practical advice and instruction which they are eminently qualified to afford.

It seems a thing to be deplored that in this country there are no establishments where astronomy is made a special subject for teaching, and where those who early evince a taste in this direction may be educated in conformity with inclination. We think that an institution giving special facilities to astronomical students, and affording instruction both in observation and computation, must prove a most efficient means of advancing the interests of the science. It cannot be denied that the work of many amateurs is rendered far less valuable than it would otherwise be by its approximate character, that is to say, by its lack of critical exactness—both as regards practice and theory. This cannot be avoided under present circumstances. A man on first becoming imbued with the desire to study astronomy as a hobby is generally in a measure isolated; he has to rely entirely upon his own exertions and what he can get out of the popular treatises upon the subject. It must, however, be conceded that he has many difficulties to encounter, both imaginary and real, before he proceeds very far; and these impediments are of such force as either to deter him altogether from advancing further, or check him so effectually that more than ordinary enthusiasm is required to surmount them. Now this could be obviated by a little timely assistance from some practical astronomer. Treatises, however exhaustive and felicitous in explanation, can never be as effective as personal instruction and example, and hence it seems a desideratum that some establishment should be arranged to afford assistance to such amateurs as are anxious to qualify themselves as practical astronomers. It is certain that could such instruction be imparted on reasonable terms, there are many amateurs who would gladly avail themselves of the opportunity. The main purpose might be to train observers to the use of equatoreals, transit instruments, micrometer work, photography, &c., and in the proper reduction of observations and computation of orbits.

The fault with amateurs seems to be that they are devoid of organisation, and generally of proper education to the work in hand. Labouring independently and intermittently they have, as a rule, no definite purpose in view other than the mere gratification of curiosity. It is obvious that some means should be adopted to attract them to suitable channels for systematic work, so that they may be enabled not only to find pleasure, as hitherto, in seeing objects of interest, but also more effectively to aid the progress of the science by making their observations of practical utility. For it cannot be doubted that the means of determining exact positions and the capacity to reduce them will naturally increase the ardour and interest of observers, and must introduce a new and powerful element to the further advancement of astronomy. The number of amateurs is steadily increasing year by year, and there are now in this country a very large assortment of efficient telescopes which are lying comparatively idle or so misdirected as to be of little service. Under these circumstances it seems desirable to make some attempt to organise the labours of amateurs in directions suitable to their means and inclinations, and to utilise such results for the benefit of astronomy.

It is generally the case that amateurs employ their instruments in spasmodic fashion, and do not tenaciously follow up important observations even when such are well within their grasp. For instance, an interesting marking on a planet may be once seen and recorded as a feature of peculiar interest, but it is then allowed to escape subsequent observation, and thus the value of the record is lost. It is not sufficient to see a thing; we must hold it as long as possible, watching its variations of motion and form, and thus possibly arriving at something definite as to its behaviour and physical character. We cannot, it is true, expect amateurs, who generally are much pressed with other engagements, to work for long periods and at inconvenient hours, because this directly means a sacrifice of other interests which it is imperative should not be neglected. But by the exercise of discretion, and by the utilisation of favourable opportunities, we think that observers, though their time may be much restricted and their instrumental means very limited, may yet contrive to do valuable work in one or other of the many attractive departments of astronomy.

The fact sometimes forces itself upon us that astronomical *work* is not nearly commensurate with the *means*. The large number of powerful instruments now in use might surely be expected to yield a most abundant harvest of results; but we cannot deny that this is far from being the case. It is sometimes the boast of the fortunate possessors of a 10-inch refractor or 12-inch reflector that their instruments are comparable, as regards performance and reach, with those employed by the first Herschel; and this being granted, how comes it that there is such a manifest lack of new discoveries and of that unwearying enthusiasm exhibited by the earlier observers? Possibly some of our best instruments are merely erected as playthings serving to gratify popular curiosity. The possessor of a "big" telescope is always courted to a certain degree by people who, though knowing little and caring nothing about the science, yet profess great interest in order to be permitted to view some of the most interesting wonders in the sky. These ordinary sightseers love novelties of any kind; moreover a view of such objects and an explanation by the "astronomer" himself is a thing to be desired, because one acquires self-importance and can dilate upon the subject to one's open-mouthed friends who have never been honoured with such marked distinction. It is needless to say that such exhibitions are mere waste of time; valuable opportunities—and they are few enough in this climate!—are lost never to return.

Many fine telescopes, though occasionally in use, are not directed to the attainment of any important ends. Year after year they are kept in splendid adjustment; a speck of dust on the lens is removed with scrupulous care; a spot of dirt on the circles is rubbed off with anxious energy, and the owner stands off a few paces to view his noble instrument with intense pleasure. How grand it looks! How massive! Surely this splendid machine is able to reveal the most crucial tests of observational astronomy? The knowledge that he has the means to see great things is in itself a sufficient satisfaction without any practical application. Besides, how can he think of departing from his invariable custom of going to bed at 10.30 p.m. and risk catching a slight cold into the bargain? His intention certainly had been to make a prolonged vigil to-night, but that was decided on in the sunny afternoon before the frosty air came on and before the fog began to rise up from the valley, and so he decides with some show of reluctance to leave it all to another night! Here is the hour, but not the man.

It is a fact to be regretted that many promising amateurs have had to relinquish, prematurely, all astronomical work on account of circumstances. A man on first experiencing the desire to do something to astronomy buys a few books, and then, when he finds it indispensable, a telescope, thus expending it may be the hard-earned savings of a few years. He becomes more interested with new facilities, and devotes much time to the subject. Ultimately the fact is realised that his business affairs

are suffering from want of proper attention, and what is of even more importance his health is failing with over-application to work. There is no alternative but to relinquish his favourite hobby, and he parts with his books and instruments for what little they will fetch. How many are there who have had this experience? How many promising observers have left the science because it offers no pecuniary rewards or benefits such as other work commands? "Life is real, life is earnest"; the telescope must be neglected for the ploughshare, and the solitary though withal happy hours of vigil must be given over to Morpheus! Many have realised all this, and though their names will never be known as astronomers, they have deserved as much credit for their disinterested efforts as many others who have from more fortunate circumstances achieved eminence.

It must be admitted that observers of the present day have many advantages over their predecessors, owing to the greater perfection and size of instruments and the conspicuous advances in the serial literature of the science. The latter has developed wonderfully during the last few years with such publications as *The Observatory*, *Copernicus*, *L'Astronomie*, *Sirius*, *Ciel et Terre*, *The Sidereal Messenger*, &c. Formerly we had but the *Astronomische Nachrichten*, *Wochenschrift für Astronomie*, and *Astronomical Register*. This leads us to hope for a corresponding increase in the number of astronomical workers.

It cannot be questioned that the essential direction of labour on the part of amateurs should be more of a systematic or methodical character than hitherto. A certain department or definite work should be taken in hand and followed up persistently. Little good is likely to accrue from erratic work or from the hasty and necessarily incomplete examination of many different objects. Every observer has a leaning towards a speciality, and he should pursue this exclusively even to the absolute neglect of other departments. Astronomy offers such a large number and variety of objects that to attempt an investigation of more than a mere fragment will tax more than the energies of a lifetime. We would therefore recommend amateurs to apply themselves sedulously to such special branches as they may individually select, for the indiscriminate use of a telescope is to be deprecated on many grounds. W. F. DENNING

## *ON THE NATURE OF INHIBITION, AND THE ACTION OF DRUGS UPON IT*[1]

### II.

M. VULPIAN has observed that the excitability of the lower parts of the spinal cord increases as the upper part is gradually shaved away, so that each layer of the cord appears to exercise an inhibitory action on the one below it. M. Brown-Séquard supposes that in each layer of the cerebro-spinal system there are both dynamogenic elements and inhibitory elements for the subjacent segments.

We are, in fact, almost obliged to assume that each nerve-cell has two others connected with it, one of which has the function of increasing, and the other that of restraining the function of the nerve-cell itself.

Applying this same hypothesis to Newton's rings, we would say that certain parts of the lens or of the glass plate possessed the property of interfering with the rays of light, or were inhibitory centres for them. Others again had the property of increasing the brightness, or were stimulating centres for them; and, moreover, that different parts of the lens or of the glass plate contained each its stimulating and inhibitory centres for different coloured rays.

The multiplication of centres in the lens and glass plate soon becomes more than the imagination can well take in; and we are at present almost precisely in the same condition regarding inhibitory and stimulating centres in the nervous system.

As soon as we get rid of the idea that the darkness caused by the interference of the rays of light at certain points is due to some peculiar property inherent in the glass, and attribute the interference simply to the relationship between the waves of light and the distance they have to travel, the whole thing becomes perfectly simple, and the same is, I think, the case in regard to inhibition in the nervous system.

Let us now take a few more examples of inhibition.

We find in experiments with the frog's foot exactly the same as on our own hand. Thus, when a little turpentine is placed upon the toes it excites a violent reflex, but if a little turpentine be injected under the skin of the same foot, the reflex is abolished.[1] We find also that irritation applied to a limited region of the skin usually causes marked reflex, but if the same stimulus be applied to the sensory nerve supplying that region, the reflex is very much less.[2] In the cases just mentioned the irritation is applied to sensory nerves of the same part of the body, and close together, and the explanation of its different results is the same as that already given for the different effects of tickling and pressure. Different sensory nerves on the same side of the body, but at some distance from each other, will also cause inhibition of motor reflexes; thus it has been shown by Schlosser[3] that simultaneous irritation of the skin over flexor and extensor surfaces will lessen reflex action.

Some years ago I observed that frogs suspended by the fore-arms with cords, or tied with their bodies against a board, reacted less perfectly to stimulation of the foot by acid than a frog suspended by a single point, as in Türck's method. Tarchanoff[4] has also observed that frogs held in the hand also respond less perfectly than when hung up; the gentle stimulation of the sensory nerves in the skin of the body appearing to exercise an inhibitory action over the reflex from the foot.

The injection of acids or irritating solutions into the mouth[5] or dorsal lymph sac[6] also exercises an inhibitory action on reflexes from the foot.

A similar effect is produced by irritating the sciatic nerve on one side by a Faradaic current, and applying a stimulus to the other foot. So long as the irritating current is passed through the sciatic nerve, no reflex movement can be elicited by stimulation of the other foot; but so soon as the Faradaic current stops, the reflex excitability again appears in the other foot.[7] As this phenomenon occurs when the influence of the brain and upper part of the spinal cord has been destroyed by a section through the cord itself, the inhibition which occurs must be due to an action which takes place in the lower portion of the spinal cord.

Stimulation of the nerves of special sense has also an inhibitory action on reflex movements. This we can readily see in ourselves, by observing our actions in the dark. If we touch something cold or wet, or if something suddenly comes against our face, we give an involuntary start, sometimes almost a convulsive one. If, however, we were able to see, we should not give a start in the least when we touched a piece of wet soap, or when the end of a curtain suddenly came against our cheek.

Without entering into the nervous mechanism through which sight effects this change in our actions, but only reducing it to its simplest form of expression, as we would

[1] Continued from p. 422.

[1] Richet, Muscles et Nerfs, Paris, 1882, p. 710.
[2] Marshall Hall, Memoirs on the Nervous System, London, 1837, p. 48.
[3] Arch. of Physiol. 1880, p. 303, quoted by Richet, *op. cit.* 709.
[4] Quoted by Richet, *op. cit.* p. 709.
[5] Setschenow, Physiologische Studien über die Hemmungsmechanismen für die Reflexthätigkeit des Rückenmarks im Gehirn des Frosches, Berlin, 1863, p. 33.
[6] Brunton and Pardington, St. Bartholomew's Hospital Reports, 1876 p. 155.
[7] Nothnagel, Centralblatt d. med. Wiss. 1869, p. 211.